BALLISTIC MISSILE DEFENSE ORGANIZATION (BMDO)
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM
Submitting Proposals – 1999 Instructions

Send Phase I proposal packages (the unbound original, to make extra copies, and six bound copies (i.e. stapled), to immediately forward to evaluators, of the full proposal, **PLUS** one additional copy of Appendices A and B only) by US mail (or any commercial delivery service). Also, APPENDIX E needs only to be with the unbound original. **DO NOT** attach APPENDIX E to the six bound copies. The mailing address follows and the BMDO STTR website address is provided.

Ballistic Missile Defense Organization
ATTN: TOR/SBIR (BOND)
1725 Jefferson Davis Highway, Suite 809
Arlington, VA 22202

For Administrative HELP ONLY call: **800-WIN-BMDO**
Internet Access: **www.winbmdo.com**

Proposals delivered by other means will not be accepted. Proposals received after the closing date will not be processed. BMDO will acknowledge receipt of proposals, **IF AND ONLY IF**, the proposal includes a self-addressed stamped envelope and a form that needs only a signature by BMDO.

All proposal submission appendices may be downloaded from the DoD STTR Website at (http://www.acq.osd.mil/sadbu/sbir/appendcs.htm). Furthermore, all companies are strongly encouraged to submit their APPENDIX A and APPENDIX B only, through the BMDO STTR Website at (http://www.winbmdo.com). Submitting the two appendices will allow BMDO to process proposals faster so that evaluations from the government technical reviewers may be received more quickly. It is in the company's best interest to submit their APPENDIX A and APPENDIX B through the Website since those proposals will be processed first. However, there will be no detrimental effect to the evaluation of the Phase I proposal if this is not accomplished.

BMDO is working toward providing a ballistic missile defense system and developing a technology base that will allow the Department of Defense to protect the warfighters against increasingly sophisticated and lethal missiles around the world. BMDO accomplishes these efforts through three broad mission focus areas: Theater Missile Defense (TMD), National Missile Defense (NMD), and Advanced Technology Developments (ATD).

TMD systems respond to and protect U.S. forces, allies, and other countries from existing and emerging short to medium range threat missiles, including cruise missiles. Seven Major Defense Acquisition Programs represent the majority of BMDO investments: PATRIOT Advanced Capability-3 (PAC-3), Navy Area Theater Ballistic Missile Defense (TBMD), Theater High-Altitude Area Defense System (THAAD), Navy Theater Wide, Medium Extended Air Defense System (MEADS), Space Based Laser (SBL), and Airborne Laser (ABL). NMD is concerned with the possibility of a limited ballistic missile strike against the United States (all 50 states). The key component systems currently under consideration include: ground-based interceptors; ground-based radars; upgraded early-warning radars; forward-based X-Band radars; battle management, command, control, and communications (BMC3); and advanced sensor technology developments. External elements to NMD include the existing early warning satellite system and its planned follow-on: the Space Based Infrared System (SBIRS) which include both the HIGH and LOW components. Finally, BMDO depends on advanced technology developments, of all aspects, to invigorate its ability to implement both TMD and NMD systems in response to increasingly sophisticated ballistic missile threats, to include cruise missiles. Therefore, the continued availability of such advanced technology developments has become an increasingly vital and critical element of the overall BMDO mission.

The intent of BMDO, first and foremost, is to seek out the most innovative technology that might enable a defense against a missile in flight -- lighter, faster, stronger, more reliable, and less expensive technologies are all of interest. Proposing companies need not know specific details or requirements of possible BMDO systems, research and development goals, or specific technology needs or requirements, but must understand that potential technologies should have application to ballistic missile defense at some level. (A better fire extinguisher,

although it may be new and innovative and exhibit a potential commercial market, does not support ballistic missile defense requirements at any level.) All topics seek to solicit Research or Research and Development proposals from the small business community. Furthermore, all selections shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not yet been fully established.

Specifically, **BMDO seeks to invest seed-capital, which supplements private sector investment support, in a product with a future market potential (preferably private sector) and a measurable BMDO benefit.** The BMDO SBIR/STTR Program will neither support nor further develop concepts **already mature enough to compete** for private capital or for mainline government research and development funds. BMDO prefers projects that move technology into the private sector market by a market-oriented small company with the best demonstration of volume commercialization. Phase I proposals should focus on the innovation of the proposed technology. Proposals should illustrate the concept or feasibility, and the merit of a Phase II for a prototype or at the very least a proof-of-concept. Phase II competition will also be judged intensely on future market possibilities and commercialization potential. The demonstration of commercialization potential is best evidenced by Phase II funding commitments submitted as part of the Phase II proposal. BMDO evaluates the presence of other indicators of commercialization potential, but only: 1) support-in-kind from private sector sources, and/or 2) a company's self-investment are considered appropriate other indicators by BMDO in assessing the private sector commercial potential of Phase II proposals.

BMDO does not specifically require co-investment in Phase II, and expects to make some Phase II awards in which the co-investment is not a factor in the selection decision each year. However, co-investment is strongly encouraged, and historically, the best companies with the best proposals demonstrate the commercialization potential of their technology by exhibiting private sector investment support, at some level, **and/or** the commitment of a government program willing to co-invest and leverage the SBIR/STTR investment at the time of selection. This co-investment standard is now set by the proposing companies, your competition, by attracting an average of a dollar-for-dollar match of private sector investment support to the SBIR/STTR funding requested. Those companies, that do not demonstrate the commercial potential of their Phase II technology through a co-investment arrangement and/or other means, do not compete well at BMDO.

Phase II proposals may be submitted anytime, for any amount, in any format after the Phase I begins. Unique efforts showing time sensitivity or submitted for *FasTrack* will be given due consideration for Phase II start-up funding and Phase I proposals may include a post-Phase I optional tasking that will permit rapid start-up if the Phase II or *FasTrack* application is approved. The latest information on how BMDO implements its *FasTrack* Program may be found at the website address under the *FasTrack* or Frequently Asked Questions (FAQs).

A Principal Investigator at the small business who is tenured faculty is **NOT** considered primarily employed by a small firm if they receive compensation from the university while performing the SBIR or STTR contract; any waiver must be requested explicitly with a justification showing a compelling rational and national need; BMDO expects to grant no such waivers.

BMDO intends for a Phase I to be only an examination of the merit of the concept or technology, that still involves technical risk, with an average cost under $65,000. Although proposed cost will not affect selection for negotiation, contracting may be delayed if BMDO reduces the proposed cost. **DO NOT** submit the same proposal, or variations thereof, to more than one BMDO topic area; each idea will be judged once in an open competition among all proposals. Furthermore, BMDO performs numerous cross-reference checks within each solicitation and with other DoD components.

Because BMDO seeks the best nation-wide experts in innovative technology, proposers may suggest technical government reviewers by enclosing a cover letter with the name, organization, address, phone number, and rationale for each suggestion. BMDO promises only to consider the suggestion and reserves the right to solicit other evaluations.

Implementation of DoD's Fast Track Policy at BMDO

Rationale for BMDO's Implementation Plan

The Defense Department's STTR program has implemented a Fast Track policy for companies which, during their Phase I efforts, attract outside investors (government or private sector) that will match Phase II STTR funding, in cash, at the matching rates described in the solicitation. Companies that obtain such outside cash investments and qualify for the STTR Fast Track receive:

- a significantly higher chance of Phase II award, and
- interim funding between Phase I and Phase II, as well as expedited processing, to ensure no significant funding delays between Phases I and II.

The following summarizes how the DoD Fast Track policy is implemented at BMDO. This Implementation Plan is specifically required since the BMDO STTR Program has evolved to the level that most companies competing for a Phase II award from BMDO obtain private-sector investment support – not just companies participating in the Fast Track. In fact, the BMDO STTR Program, in its decision process for Phase II award selections, uses as a primary selection criterion (but not the only criterion) a company's ability to demonstrate commercial potential by attracting private-sector investment support during the performance of the Phase II. The value that BMDO places on this support depends on a number of factors, including the type of investment support (e.g. cash, support-in-kind, or self-investment), amount of the matching support, and timing of the matching support.

Thus, implementation of the DoD Fast Track policy at BMDO needs to occur in such a way that Phase II proposals with the greatest commercial potential, as measured by the amount of private-sector investment support, receive the highest priority for Phase II award.

BMDO's Fast Track Implementation Plan – "*FasTrack*" – has been in effect since the FY96.1 DoD SBIR solicitation and is approved for implementation by the Under Secretary of Defense for Acquisition and Technology (USD(A&T)).
BMDO's *FasTrack*:

- is consistent with the general principles of the DoD Fast Track policy, described above; and
- has demonstrated a track record of success. Specifically, BMDO implemented its *FasTrack* policy during 1996-1997 using the procedures outlined below, with the approval of the USD(A&T). 31 Phase I projects qualified for BMDO *FasTrack* during this time period -- the highest amount per dollar of SBIR funds of any DoD SBIR component. 30 of these projects were selected for Phase II award and also received interim funding between Phase I and Phase II.

The BMDO *FasTrack* Implementation Plan

a. In General. BMDO implements a *FasTrack* STTR process for companies which, during their Phase I projects, attract one or more private-sector, outside investors that will match Interim STTR Funding (between Phase I and Phase II) and Phase II STTR funding, in cash, and at the matching rates described in subsection (c) below. Such companies shall receive (subject to the qualifications described herein):

(1) Interim Funding of $30,000 to $40,000 between Phase I and Phase II;

(2) BMDO's highest priority for Phase II selection and award; and

(3) An expedited Phase II selection decision and an expedited Phase II award.

Questions about the BMDO *FasTrack*, including any of the provisions discussed below, should be directed to the BMDO SBIR/STTR Program Manager, Mr. Jeff Bond, at 703-604-3538 (FAX -3956). The BMDO SBIR/STTR Home Page contains a BMDO *FasTrack* Timeline showing the schedule of events for a company participating in BMDO's *FasTrack* program (see http://www.futron.com/bmdo/3FAST/fasttrk.gif).

b. How to Qualify for BMDO *FasTrack*. To qualify for BMDO *FasTrack*, a company that has received a BMDO-sponsored Phase I award must submit the following five items within four (4) months of the effective date of the Phase I award. (Note: The effective date is the date on which the Phase I contract actually takes effect and the company may begin to incur costs under the contract.):

(1) A completed DoD/BMDO *FasTrack* application form (which follows this Plan). A copy of the completed DoD/BMDO *FasTrack* application must also be sent to the DoD SBIR/STTR Program Manager at the address listed on the back of the form.

(2) A Commitment Letter from a private sector, outside investor (or investors) – such as another company, a venture capital firm, or an "angel" investor – stating that the investor(s) will match the Interim Funding and the Phase II funding, in cash, at the matching rates listed in subsection (c) below. The investment must qualify as a "Fast Track investment," and the investor as an "outside investor," as defined in Reference E of the STTR solicitation (i.e. the investor cannot be an affiliate of the STTR company). Additionally, under BMDO *FasTrack*, federal, state, and foreign governments do not qualify as valid investors.

The Commitment Letter should state that the investor's funds will pay for work that is connected to the specific STTR project, and should also describe the general nature of that work. The work funded by the investor may be additional research and development on the project or, alternatively, it may be other activity related to the project (e.g., marketing) that is outside the scope of the STTR contract. The investor may provide its matching funds to the company contingent on the company's being selected for Phase II (procedures for accomplishing this must be discussed with the BMDO SBIR/STTR Program Manager, Mr. Jeff Bond, at 703/604-3538).

(3) A concise Statement of Work and Cost Proposal for the Interim Funding effort (typically less than 4 pages in length).

(4) An Executive Summary of the current status of the Phase I effort (typically less than 4 pages in length).

(5) A copy of the first page of the Phase I contract (i.e. the signature page).

Additionally:

(1) The company must submit its Phase II proposal within five (5) months of the effective date of the Phase I award;

(2) The company must submit a Private Sector Investment Certification (PSIC) within seven (7) months of the effective date of the Phase I award, indicating that the investor's matching funds have been transferred to the STTR company. The PSIC consists of: (a) a letter, signed by the investor and the company, that states the amount of cash that has been transferred; and (b) documentation to substantiate that the transfer of funds has occurred (e.g. a bank statement, wire transfer, or copies of canceled checks).

If not all the investor's funds are transferred to the company by the end of the seventh month, the company will still qualify for the *FasTrack*. However, it will receive a lower preference for Phase II selection than other *FasTrack* participants, as described in subsection (e) below. Additionally, BMDO will match any investor funds transferred to the company after the seventh month at only a $1 to $1

matching rate, rather than at the more favorable matching rates listed in subsection (c) below. Also, BMDO will only provide installments of Phase II funds to the company after corresponding installments of matching funds have been transferred from the investor to the company. (e.g. The company and investor must certify that $60,000 in matching funds has been transferred to the company before BMDO will release a corresponding $60,000 installment of Phase II STTR funds.)

A company which fails to meet these conditions in their entirety within the time frames indicated will generally be disqualified from BMDO *FasTrack* consideration. If disqualified, the company shall still be eligible to compete for a "standard" Phase II award through the regular BMDO Phase II procedures with no penalty.

c. Matching Rates. BMDO *FasTrack* matching rates differ slightly from the matching rates under the DoD Fast Track policy. The BMDO rates are as follows:

(1) For STTR companies that have 10 or fewer employees **and** have never received a Phase II SBIR or STTR award from any federal agency, the investor's Commitment Letter must state that the investor shall provide at least $1 to match every $4 of Interim STTR Funding and Phase II funding. (e.g. If the company proposes Interim STTR Funding of $40,000 and Phase II STTR funding of $600,000, the investor must provide a commitment of matching funds of $10,000 and $150,000 respectively for the two efforts.)

(2) For STTR companies that have received fewer than five (5) Phase II SBIR/STTR awards from the federal government, and do not fall into category (1) above, the investor's Commitment Letter must state that the investor shall provide at least $1 to match every $2 of Interim STTR Funding and Phase II funding. (e.g. If the company proposes Interim STTR Funding of $40,000 and Phase II STTR funding of $600,000, the investor must provide a commitment of matching funds of $20,000 and $300,000 respectively for the two efforts.)

(3) For STTR companies that have received five (5) Phase II SBIR/STTR awards or more from the federal government, the investor's Commitment Letter must state that the investor shall provide at least $1 to match every $1 of Interim STTR Funding and Phase II funding. (e.g. If the company proposes Interim STTR Funding of $40,000 and Phase II STTR funding of $600,000, the investor must provide a commitment of matching funds of $40,000 and $600,000 respectively for the two efforts.)

d. Benefits of Qualifying for BMDO *FasTrack*. A company that qualifies for BMDO *FasTrack* will:

(1) Receive Interim Funding of $30,000 to $40,000 between Phase I and Phase II (However, the Interim Funding plus the Phase I award shall not exceed $100,000).

(2) Receive BMDO's highest priority for selection for Phase II award. Specifically, BMDO shall select the company for Phase II award assuming its project meets or exceeds a "technically sufficient" level, as described in Section 4.3 of the current solicitation. As discussed in subsection (e) below, among *FasTrack* companies, those that receive all of their investor matching funds within seven months after the effective start date of Phase I receive higher preference for selection than *FasTrack* companies that receive some or all matching funds after the seventh month.

(3) Receive notification of whether it has been selected for Phase II award within 60 days after the completion of its Phase I project.

(4) If selected, receive its Phase II award within an average of five months after the completion of its Phase I project, to ensure no significant funding delay between Phase I and Phase II. (Note: Although BMDO makes all of its Phase II selection decisions, the Phase II contracts are processed by other DoD organizations, and BMDO therefore does not directly control the timing of the contract awards.

However, most BMDO *FasTrack* awards have been made within five months after the completion of the Phase I effort.)

e. BMDO *FasTrack* Preference Levels. As discussed above, companies that qualify for the BMDO *FasTrack* receive BMDO's highest priority for Phase II selection and award. Among *FasTrack* companies, those that receive all of their investor matching funds within seven months after the effective start date of Phase I receive higher preference for selection than *FasTrack* companies that receive some or all matching funds after the seventh month, as follows:

Preference Level 1 applies to *FasTrack* companies that receive **all** of the matching funds for the Interim effort and the Phase II effort within seven months after the effective start date of the Phase I award.

Preference Level 2 applies to *FasTrack* companies that receive all of the matching funds for the Interim effort but only some of the matching funds for the Phase II effort within seven months after the effective start date of the Phase I award.

Preference Level 3 applies to *FasTrack* companies that receive all the matching funds for the Interim effort but none of the matching funds for the Phase II effort within seven months after the effective start date of the Phase I award.

U.S. DEPARTMENT OF DEFENSE / Ballistic Missile Defense Organization

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM

FAST TRACK APPLICATION FORM

Failure to fill in all appropriate spaces may cause your proposal to be disqualified

FAST TRACK PROGRAM QUALIFICATIONS To qualify for the BMDO STTR Fastrack, a company must complete this form and meet the other requirements detailed in the BMDO section of this solicitation (and also on the BMDO web site). Instructions are on the back.

TOPIC #:	CONTRACT #:	PHASE I EFFECTIVE START DATE:	PHASE I COMPLETION DATE:
PHASE I TITLE:			
FIRM:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	
OUTSIDE INVESTOR:		TAXPAYER ID#:	
STREET:			
CITY:	STATE:	ZIP:	

BUSINESS CERTIFICATION:

	YES	NO	MATCHNING RATE	
> Do you have 10 or fewer employees and have never received a Phase II SBIR /STTR award from the federal government (including DoD)? (if YES, the minimum Investor matching rate is $1 for every $4 in BMDO STTR funds)	☐	☐	$1 : $4	☐
> Have you received 5 or more Phase II SBIR/STTR awards from the federal government (including DoD)? (If YES, the minimum Investor matching rate is $1 for every $1 in BMDO STTR funds)	☐	☐	$1 : $1	☐
> If you answered NO to both questions, the minimum Investor matching rate is $1 for every $2 in BMDO STTR funds.			$1 : $2	☐
> Does the outside funding proposed in this application qualify as a "Fastrack investment", and does the investor qualify as an "outside investor", as defined in DoD Fast Track Guidance (Reference E)? If you have any questions about this, call the DoD SBIR Help Desk (800-382-4634). The Help Desk will refer any policy and/or substantive questions to appropriate DoD personnel for an official response.	☐	☐		

Caution: knowingly and willfully making any false, fictitious, or fraudulent statements or representations above may be felony under the Federal Criminal False Statement Act (18 U.S.C. Sec 1001), punishable by a fine of up to $10,000, up to five years in prison, or both.

PROPOSED STTR AND MATCHING FUNDS:

- Proposed STTR Interim Funding: $_____
- Proposed STTR Phase II Funding: $_____
- Investor Matching Interim Funding: $_____
- Investor Matching Phase II Funding: $_____

FIRM OFFICIAL	OUTSIDE INVESTOR OFFICIAL
NAME:	NAME:
TITLE:	TITLE:
TELEPHONE:	TELEPHONE:
SIGNATURE: DATE:	SIGNATURE: DATE:

Nothing on this page is classified or proprietary information/data

Application page No. 1

INSTRUCTIONS FOR COMPLETING APPENDIX D (BMDO)

SUBMISSION:

Submit all items to:

Ballistic Missile Defense Organization
ATTN: TOI/SBIR (Bond)
1725 Jefferson Davis Highway
Suite 809
Arlington, VA 22202

IMPORTANT: Please also send a copy of this application form, when completed, to:
DoD SBIR Program Manager
3061 Defense Pentagon, Room 2A338
Washington, DC 20301-3061

For further information on the BMDO SBIR Program, visit the BMDO SBIR Web Site **http://www.futron.com/bmdo/bmdo.htm**

REQUEST FOR COPIES OF THIS FORM:

Additional copies of this form may be downloaded from the DoD SBIR Web Site (http://www.acq.osd.mil/sadbu/sbir). They may also be obtained from your State SBIR Organization (Reference D) or:

DoD SBIR Support Services
2850 Metro Drive, Suite 600
Minneapolis, MN 55425-1566
(800) 382-4634

BMDO FY99 STTR TOPIC DESCRIPTIONS

BMDO 99T-001 TITLE: Sensors

INTRODUCTION: BMDO investigates various sensor technologies for both TMD and NMD applications. As such, a significant investment is made each year in the continued development of increasingly robust and sophisticated sensor systems which may eventually find their utilization in a ballistic missile technology program or major defense acquisition program. All areas of the electromagnetic spectrum provide potential avenues toward finding and disabling a ballistic missile in flight. Furthermore, sensor systems, components, sub-components, and piece part specifics are constantly under evaluation by the various TMD and NMD elements for replacement by the latest technology developments from industry. Research or Research and Development efforts selected under this topic shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not been fully established.

DESCRIPTION: Sensors and their associated systems/sub-systems will function as the "eyes and ears" for ballistic missile defense applications, providing early warning of attack, target detection/classification/identification, target tracking, and kill determination. New and innovative approaches to these requirements using unconventional and innovative techniques are encouraged across a broad band of the electromagnetic spectrum, from radar to gamma rays. Passive, active, and interactive techniques for discriminating targets from backgrounds, debris, decoys, chaff, electronic countermeasures, and other penetration aids are specifically sought. Sensor-related device technology is also needed. Examples of some of the technology specific areas are: cryogenic coolers (open and closed systems), cryogenic heat transfer, superconducting focal plane detector arrays (for both the IR and sub-mm spectral regions), next generation InSb focal plane arrays, signal and data processing algorithms (for both conventional focal planes and interferometric imaging systems), low-power optical and sub-mm wave beam steering, range-doppler lidar and radar, passive focal plane imaging (long-wavelength infrared to ultra-violet; novel information processing to maximize resolution while minimizing detector element densities), large format focal plane arrays (cooled and un-cooled), interferometry (both passive and with active illumination), QWIPs, integrated UV/VIS/MIR/IR focal plane arrays, gamma-ray detection, neutron detection, intermediate power frequency agile lasers for diffractive beam steering and remote laser induced emission spectroscopy, lightweight compact efficient fixed frequency radiation sources for space-based ballistic missile defense applications (uv-sub-mm wave), new optics and optical materials. Entirely new and high-risk approaches are also sought. Please indicate the particular identifying letter your specific proposal/technology addresses:

BMDO99T001**A** - Acoustic and Seismic
BMDO99T001**B** - Radar and MMW
BMDO99T001**C** - UV (<0.3 microns)
BMDO99T001**D** - Visible (0.3 - 0.9 microns)
BMDO99T001**E** - IR (>0.9 microns)
BMDO99T001**F** - Gamma/X-Ray
BMDO99T001**G** - Other

SUCCESSFUL PHASE 3/DUAL-USE COMMERCIALIZERS (Real-World Examples): Company G, with commercial sales of $15M+, is noted for its laser diode pumped q-switched solid state laser products. Company H, with a market cap of $47M+, transferred its microwave based infrared detector and superconducting millimeter wave mixer technologies for a variety of cryogenic systems and products. Company OO's high power laser array transmitters are utilized on the next generation of military and commercial satellites for communications.

DOD KEY TECHNOLOGY AREAS: Sensors, Electronics

BMDO 99T-002 TITLE: Electronics and Photonics

INTRODUCTION: In implementing its TMD and NMD program activities, BMDO is continuing its developments of such efforts as the PATRIOT Advanced Capability-3 (PAC-3) missile system which has four major systems components: radar, engagement control station, launching station, and interceptors. The Navy Area Wide system will develop a sea-based capability that builds upon the existing AEGIS/Standard Missile air defense system. This system is based on the AEGIS-class cruisers and destroyers, which provide all elements of missile defense and are particularly suited to protecting forces moving inland from the sea. The Theater High-Altitude Area Defense System (THAAD) system will form the largest umbrella of missile protection in a specific theater, arching over all other missile defense systems. THAAD consists of four major systems components: truck-mounted launchers; interceptors; radar system; and battle management, command, control, communications, and intelligence (BMC3I). These increasingly sophisticated systems will provide the opportunity to destroy short and medium range ballistic missiles and other threats in the atmosphere far enough away that falling debris will not endanger friendly forces. The various BMDO technology and acquisition programs, in support of the TMD and NMD missions, are continually evaluating the latest advanced technology developments from industry as potential replacements for the current state-of-the-art sensor systems, components, sub-components, or piece part specifics. Research or Research and Development efforts selected under this topic shall demonstrate and involve a degree of technical risk where the technical feasibility of the proposed work has not been fully established.

DESCRIPTION: The necessary advances in electronics for the many ballistic missile defense applications will require advances in electronics materials. Primary emphasis lies in advancing the capability of integrated circuits, detectors, sensors, large-scale integration, radiation hardness, and all electronic components. Novel quantum-well/superlattice structures that allow the realization of unique elective properties through "band gap engineering" are sought, as are new organic and polymer materials with unique electronic characteristics. In addition, exploitation of the unusual electronic properties of gallium nitride is of considerable interest. Specifically, under high speed switching conditions at >10GHz and/or cryogenic temperatures. Among the many BMDO electronic needs and interest are advances in high frequency transistor structures, solid state lasers, optical detectors, low dielectric constant packaging materials, tailored thermal conductivity, microstructural waveguides, multilayer capacitors, single-electron transistors, metallization methods for repair of conducting paths in polyceramic systems, and sol-gel processing for packaging materials.

Also, dense computing capability is sought in all architectural variations, from all optic to hybrid computers. Specific examples of areas to be addressed include, but are not limited to, high speed multiplexing, monolithic optoelectronic transmitters, holographic methods, reconfigurable interconnects, optoelectronic circuits, and any other technology contributing to advances in intra-computer communications, optical logic gates, bistable memories, optical transistors, and power limiters. Non-linear optical materials advancements and new bistable optical device configurations.

SUCCESSFUL PHASE 3/DUAL-USE COMMERCIALIZERS (Real-World Examples): Company R took a unique technology approach in addressing fiber-optic and other optical communications applications to both the military and commercial industry. Company S is providing a low-loss electro-optical switching array, Company T is providing optical bus extenders and fiber-optic modulators, Company U has funded technology which utilized wavelength division multiplexing techniques; all three support the ever growing optical communication industry. Company Y, with a market cap of $359M+, commercialized technology that allowed for the delivery of ultra-pure materials to semiconductor thin film reactors, which benefit all aspects of the commercial and military markets. Company Z, with a market cap of $12M+, manufactures radiation detection devices and was funded for avalanche photodiode arrays. Company AA, with a market cap of $112M+, has a substantial market share of the atomic layer epitaxy growth method of semiconductor compound materials based on efforts funded under this topic. Company BB, with a market cap of $244M+, which manufactures flat panel display devices, received some initial funding for their silicon-on-insulator films and organometallic chemical vapor deposition technology developments. Company CC, with a market cap of $222M+, commercialized technology based on degradation resistant laser diodes. Company DD, with a market cap of $10M+, is commercializing technology based on its surge suppression devices and marketed as SurgX. Company EE, with a market cap of $357M+, had initial funding for its high bandgap compounds and laser diode products to develop a number of commercial and military products, and has graduated from small business status. Company KK established a multilayer coating technology that can be easily

transported to any location for application. Company FF developed a magnetoresistive non-volatile random access memory chip, which is also radiation hardened, and is utilized in a number of space applications for the military and commercial sectors. Company LL, with a market cap of $47M+, was started with their first Phase I from this topic and the products are used in electronics, structural ceramics, composites, cosmetics and skin care, and as industrial catalysts. Company NN, with a market cap of $228M+, is leveraging technology developed under this topic for the efficient production of semiconductors from waste recovery during the manufacturing process.

DOD KEY TECHNOLOGY AREAS: Air Vehicles/Space Vehicles; Command, Control and Communications; Computing and Software; Electronics; Electronic Warfare/Directed Energy Weapons; Materials, Processes and Structures; Sensors; Surface/Under Surface/Ground Vehicles